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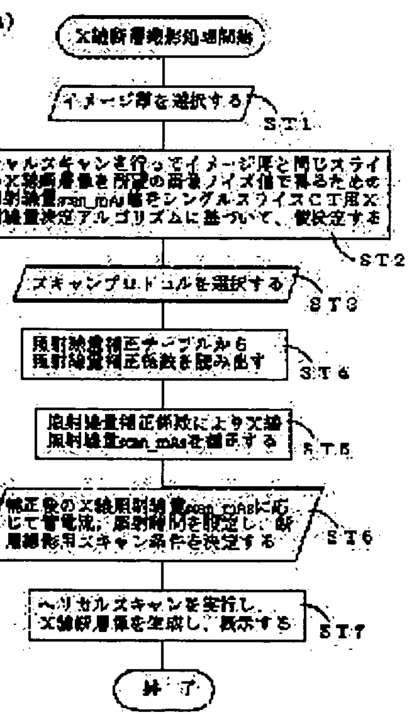
(54) METHOD OF DETERMINING CONDITION FOR TOMOGRAPHIC SCANNING, METHOD OF TOMOGRAPHY, AND X-RAY CT INSTRUMENT

(図4)



(57)Abstract:

PROBLEM TO BE SOLVED: To determine the exposure in executing the helical scanning by a CT instrument with a multi-detector without excess/deficiency to an allowable value of image noise.

SOLUTION: The thickness of a tomographic image to be produced with the helical scanning by the X-ray CT instrument with a multi-detector is selected (Step ST1), the X-ray exposure when a tomographic image with the selected thickness is produced by a single slice CT is tentatively determined by the exposure determination algorism for the single slice CT (Step ST2). After that, a scanning protocol is selected (Step ST3), an exposure correcting coefficient is read out from an exposure correcting coefficient table corresponding to the selected thickness of the image (Step ST4), and the X-ray exposure is corrected by the exposure correcting coefficient (Step ST5). Then at least either the tube current or the radiation period is set to determine the condition for tomographic scanning (Step ST6), and a tomographic image is displayed by executing the helical scanning (Step ST7). Therefore, such deficiency as a subject being unnecessarily exposed to radiation can be prevented.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the X-ray CT scanner concerning 1 operation gestalt of this invention.
[Drawing 2] It is the mimetic diagram showing an X-ray tube, a collimator, and a multi-detector.
[Drawing 3] It is the explanatory view showing the contents of the exposure dose correction factor table.
[Drawing 4] It is the flow Fig. showing the X-ray-computed-tomography processing by the X-ray CT scanner of drawing 1 .
[Drawing 5] It is the flow Fig. showing an example of the conventional X-ray irradiation dosage decision processing.
[Description of Notations]
1 Actuation Console
2 Input Unit
3 Central Processing Unit
6 CRT
8 Exposure Dose Correction Factor Table
10 Photography Berth
21 X-ray Tube
23 Collimator
27 Multi-Detector
27A The 1st detector train
27B The 2nd detector train
27C The 3rd detector train
27D The 4th detector train
Xr X-ray beam
Xo X-ray beam width of face
S Aperture
SC Scanning core

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the scanning condition decision approach for tomography, the tomography approach, and X-ray CT scanner which can determine quantity of radiation the neither more nor less to the allowed value of an image noise value in more detail about the scanning condition decision approach for tomography, the tomography approach, and X-ray CT (Computed Tomography) equipment.
[0002]
[Description of the Prior Art] Drawing 5 is the flow Fig. showing an example of the conventional X-ray irradiation dosage decision processing in the X-ray CT scanner equipped with the single detector which has the detector train of one train. At step SU1, scout photography of a rectangular 2-way generates a sagittal plane (sagittal plane) image and a coronal plane (coronal plane) image. At step SU2, tube voltage, slice thickness, and a reconstruction function are chosen. At step SU3, the scanning location (slice location) in X-ray computed tomography is determined with reference to a scout image.
[0003] It is the standard deviation SDsigmapixel of the image SD which assumed analyte to be a circular cross section at step SU4 based on the projection inferior-surface-of-tongue product Sobject, default X-ray irradiation dosage default_mAs (product of the tube electric current and irradiation time), and slice thickness Th when photoing analyte on default photography conditions SDsigmapixel**root {Sobject/(default_mAsxTh)}
It is alike and computes more. It is considered that this standard deviation SDsigmapixel is an image noise value. In addition, said projection inferior-surface-of-tongue product Sobject is estimated from said sagittal plane image and said coronal plane image.
[0004] At step SU5, said standard deviation SDsigmapixel is amended according to the attenuation ratio of a sagittal plane image and a coronal plane image, and it asks for standard deviation SD sigma'pixel according to the actual cross-section configuration of analyte. At step SU6, allowed value SDsigmatarget of the standard deviation (image noise value) of said image SD is inputted. At step SU7, X-ray irradiation dosage scan_mAs which fills standard deviation SDsigmatarget for every slice is computed by scan_mAs=default_mAsx(SD sigma'pixel/SDsigmatarget) 2.
[0005] In addition, the basic principle of the X-ray irradiation dosage decision processing like the above is indicated by JP,11-104121,A.
[0006]
[Problem(s) to be Solved by the Invention] By the way, helical scan is performed with the X-ray CT scanner equipped with the multi-detector which has two or more detector trains arranged in parallel recently, and weight is attached to the data of the slice (multi-slice) corresponding to each train of said multi-detector, it compounds for image reconstruction, and the technique which increases in substantial slice thickness (image thickness), i.e., image thickness, is developed. That is, the large X-ray tomogram for image thickness can be obtained by what the large range of the data used for image reconstruction is taken even when X-ray beam width of face is narrowed (the engine speed of an X-ray tube and a multi-detector is made larger than one rotation). In this case, there may be less X-ray irradiation dosage required to obtain the X-ray tomogram for the same image noise value than the time of 1 rotation. However, also with the X-ray CT scanner equipped with the multi-detector, since the X-ray irradiation dosage decision processing for the above-mentioned conventional single-slice CTs (refer to drawing 5) was followed as it was, depending on scanning conditions, the actual image noise level became larger than the allowed value of an image noise value, and was small. And when it

becomes large, required image quality is not acquired, but when it becomes small, there is a trouble that X-ray irradiation dosage increases superfluously. Then, the purpose of this invention is to offer the scanning condition decision approach for tomography, the tomography approach, and X-ray CT scanner which can determine the quantity of radiation in the case of performing helical scan the neither more nor less to the allowed value of an image noise value with the CT scanner equipped with the multi-detector.
[0007]
[Means for Solving the Problem] In the 1st viewpoint, this invention The preliminary decision of the quantity of radiation in the case of obtaining the tomogram for the image thickness which should be generated by the helical scan by the CT scanner equipped with the multi-detector which has two or more detector trains arranged in parallel by the single-slice CT is carried out by the quantity-of-radiation decision algorithm for single-slice CTs. Helical scan is amended to the quantity of radiation from which the image noise value of the tomogram performed and obtained does not serve as excess and deficiency to an allowed value, and the scanning condition decision approach for tomography characterized by determining the scanning conditions for tomography which suited this quantity of radiation is offered. It becomes possible to compute correctly the minimum quantity of radiation which fills the conditions of an image noise value with the scanning condition decision approach for tomography by the 1st viewpoint of the above since the quantity of radiation by which the preliminary decision was carried out is amended so that the image noise value of the tomogram obtained by performing helical scan may not serve as excess and deficiency to an allowed value in order to obtain the tomogram for predetermined image thickness. For this reason, while avoiding un-arranging [from which quantity of radiation is insufficient and required image quality is not acquired], the situation where quantity of radiation becomes superfluous and analyte is contaminated superfluously can be prevented. Moreover, since the optimal quantity of radiation can be determined by full automatic or semi-automatic, an operator's burden is mitigable.
[0008] In the 2nd viewpoint, this invention chooses the image thickness of the tomogram which should be generated by the helical scan by the CT scanner equipped with the multi-detector which has two or more detector trains arranged in parallel. The preliminary decision of the quantity of radiation in the case of obtaining the tomogram for said image thickness by the single-slice CT is carried out by the quantity-of-radiation decision algorithm for single-slice CTs. Choose the scanning conditions of the helical scan which should be performed, and said quantity of radiation which carried out the preliminary decision is amended so that it may become the quantity of radiation from which the image noise value of the tomogram obtained by performing the helical scan by said scanning conditions does not serve as excess and deficiency to an allowed value. The scanning condition decision approach for tomography characterized by determining the scanning conditions for tomography which suited the amended this quantity of radiation is offered. By the scanning condition decision approach for tomography by the 2nd viewpoint of the above, the same operation as the scanning condition decision approach for tomography by the 1st viewpoint of the above is done so. Moreover, the image thickness of the X-ray tomogram which should be generated can be chosen. Furthermore, [0009] which can choose the scanning conditions of helical scan In the 3rd viewpoint, this invention offers the scanning condition decision approach for tomography characterized by setting up preferentially the supply current to the source of an exposure, and one side of irradiation time that the exposure line of said amended quantity of radiation should be irradiated in the scanning condition decision approach for tomography of the 1st viewpoint of the above, or the 2nd viewpoint of the above. By the scanning condition decision approach for tomography by the 3rd viewpoint of the above, when the supply current to the source of an exposure is set up preferentially, it can prevent certainly that the load which joins the source of an exposure becomes excessive. Moreover, when irradiation time is set up preferentially, a motion of analyte can adjust scanning time amount in consideration of the effect which it has on image quality.
[0010] In the 4th viewpoint, this invention is set to the scanning condition decision approach for tomography of the 2nd viewpoint of the above, or the 3rd viewpoint of the above. The weight function at the time of compounding the data of each train of said multi-detector for image reconstruction, The scanning condition decision approach for tomography characterized by changing at least one element in exposure line beam width and the passing speed of the photography berth in which analyte is laid, and adjusting image thickness is offered. By the scanning condition decision approach for tomography by the 4th viewpoint of the above, when changing the weight function for image reconstruction, image thickness can be adjusted without mechanical control only by the processing on an operation. Moreover, when changing exposure line beam width, image thickness can be adjusted by controlling the aperture width of the aperture of a collimator. Furthermore, when changing the passing speed of a photography berth, image thickness can be adjusted by controlling the drive system of a photography berth.

[0011] In the 5th viewpoint, the scanning condition decision approach for tomography characterized by this invention amending said quantity of radiation with the quantity-of-radiation correction factor which made the reference value quantity of radiation when performing the axial scan which made slice thickness equal to said image thickness in one scanning condition decision approach for tomography of the 1st viewpoint of the above to the 4th viewpoint of the above is offered. By the scanning condition decision approach for tomography by the 5th viewpoint of the above, since quantity of radiation is amended with the quantity-of-radiation correction factor which made quantity of radiation of an axial scan the reference value, the quantity of radiation which suited scanning conditions is computable by the easy operation.
[0012] In the 6th viewpoint, the tomography approach characterized by for this invention performing the helical scan of the scanning conditions for tomography determined by one scanning condition decision approach for tomography of the 1st viewpoint of the above to the 5th viewpoint of the above, and generating a tomogram is offered. By the tomography approach by the 6th viewpoint of the above, since a tomogram is generated using the scanning conditions for tomography determined by the above-mentioned scanning condition decision approach for tomography, the tomogram which has required image quality can be obtained in the minimum amount of exposures.
[0013] In the 7th viewpoint, this invention Are concurrent. The X-ray irradiation dosage in the case of obtaining the X-ray tomogram for the image thickness of the X-ray tomogram which should be generated by the helical scan by the X-ray CT scanner equipped with the multi-detector which has two or more arranged detector trains by the single-slice CT by the X-ray irradiation dosage decision algorithm for single-slice CTs Choose the scanning conditions of the helical scan which should carry out a preliminary decision and which should be performed, and said X-ray irradiation dosage is amended so that it may become the X-ray irradiation dosage from which the image noise value of the X-ray tomogram obtained by performing the helical scan by said scanning conditions does not serve as excess and deficiency to an allowed value. The scanning condition decision approach for tomography characterized by determining the scanning conditions for tomography which suited the amended this X-ray irradiation dosage is offered. By the scanning condition decision approach for tomography by the 7th viewpoint of the above, while avoiding un-arranging [for which X-ray irradiation dosage is insufficient for, and the image quality of an X-ray tomogram deteriorates extremely], the situation where X-ray irradiation dosage becomes superfluous and analyte is contaminated superfluously can be prevented.
[0014] In the 8th viewpoint, this invention offers the scanning condition decision approach for tomography characterized by setting up preferentially the tube electric current of an X-ray tube, and one side of irradiation time that said amended X-ray irradiation dosage should be irradiated in the scanning condition decision approach for tomography of the 7th viewpoint of the above. By the scanning condition decision approach for tomography by the 8th viewpoint of the above, when the tube electric current of an X-ray tube is set up preferentially, it can prevent certainly the load which joins an X-ray tube becoming excessive, and forming a short life. Moreover, when irradiation time is set up preferentially, a motion of analyte can adjust scanning time amount in consideration of the effect which it has on image quality.
[0015] In the 9th viewpoint, the scanning condition decision approach for tomography characterized by this invention amending said X-ray irradiation dosage with the quantity-of-radiation correction factor which made the reference value X-ray irradiation dosage when performing the axial scan which made slice thickness equal to said image thickness in the scanning condition decision approach for tomography of the 7th viewpoint of the above or the 8th viewpoint of the above is offered. By the scanning condition decision approach for tomography by the 9th viewpoint of the above, since X-ray irradiation dosage is amended by making X-ray irradiation dosage of an axial scan into a reference value, the X-ray irradiation dosage which suited scanning conditions is computable by the easy operation.
[0016] In the 10th viewpoint, this invention is set to the scanning condition decision approach for tomography of the 9th viewpoint of the above. X-ray irradiation dosage when performing the axial scan of the same slice thickness as desired image thickness by the single-slice CT to the phantom which imitated CT value distribution of standard analyte is made into a reference value. It asks for the quantity-of-radiation correction factor which expressed the X-ray irradiation dosage for obtaining the X-ray tomogram for an image noise value equivalent to said axial scan by the helical scan using a multi-detector with the scale factor to said reference value. The scanning condition decision approach for tomography characterized by carrying out the multiplication of this quantity-of-radiation correction factor to said X-ray irradiation dosage which carried out the preliminary decision, and amending this X-ray irradiation dosage. By the scanning condition decision approach for tomography by the 10th viewpoint of the above, since X-ray irradiation dosage is amended with the quantity-of-radiation correction factor which makes a reference value X-ray irradiation dosage when performing an axial scan to a phantom, the X-ray irradiation dosage which suited photography of analyte is computable with a sufficient precision.

[0017] In the 11th viewpoint, the tomography approach characterized by for this invention performing the helical scan of the scanning conditions for tomography determined by one scanning condition decision approach for tomography of the 7th viewpoint of the above to the 10th viewpoint of the above, and generating an X-ray tomogram is offered. By the tomography approach by the 11th viewpoint of the above, since an X-ray tomogram is generated using the scanning conditions for tomography determined by the above-mentioned scanning condition decision approach for tomography, the X-ray tomogram which has required image quality can be obtained in the minimum amount of X-ray exposures.
[0018] The multi-detector which has two or more detector trains arranged in the 12th viewpoint in parallel to the X-ray tube with which this invention carries out outgoing radiation of the X-ray, The X-ray irradiation dosage preliminary decision means which carries out the preliminary decision of the X-ray irradiation dosage in the case of obtaining the X-ray tomogram for the image thickness which should be generated by the helical scan using the multi-detector by the single-slice CT by the X-ray irradiation dosage decision algorithm for single-slice CTs, An X-ray irradiation dosage amendment means to amend said X-ray irradiation dosage which carried out the preliminary decision so that it may become the X-ray irradiation dosage from which the image noise value of the X-ray tomogram obtained by performing helical scan does not serve as excess and deficiency to an allowed value, The X-ray CT scanner characterized by providing the scanning control means which controls the helical scan which suits said amended X-ray irradiation dosage is offered. The minimum X-ray irradiation dosage which fills the conditions of an image noise value with the X-ray CT scanner by the 12th viewpoint of the above since the X-ray irradiation dosage by which the preliminary decision was carried out is amended so that the image noise value of an X-ray tomogram may not serve as excess and deficiency to an allowed value in order to obtain the X-ray tomogram for predetermined image thickness is computed correctly, and it becomes possible to perform the helical scan which suited it. For this reason, while avoiding un-arranging [from which X-ray irradiation dosage is insufficient, and required image quality is not acquired], the situation in which X-ray irradiation dosage becomes superfluous and analyte carries out an X-ray exposure superfluously can be prevented.
[0019] The multi-detector which has two or more detector trains arranged in the 13th viewpoint in parallel to the X-ray tube with which this invention carries out outgoing radiation of the X-ray, An image thickness selection means to choose the image thickness of the X-ray tomogram which should be generated by the helical scan using the multi-detector, The X-ray irradiation dosage preliminary decision means which carries out the preliminary decision of the X-ray irradiation dosage in the case of obtaining the X-ray tomogram for said image thickness by the single-slice CT by the X-ray irradiation dosage decision algorithm for single-slice CTs, A scanning condition selection means to choose the scanning conditions of the helical scan which should be performed, An X-ray irradiation dosage amendment means to amend said X-ray irradiation dosage which carried out the preliminary decision so that it may become the X-ray irradiation dosage from which the image noise value of the X-ray tomogram obtained by performing the helical scan by said scanning conditions does not serve as excess and deficiency to an allowed value, The X-ray CT scanner characterized by providing the scanning control means which controls the helical scan which suits said amended X-ray irradiation dosage is offered. In the X-ray CT scanner by the 13th viewpoint of the above, the same operation as the X-ray CT scanner by the 12th viewpoint of the above is done so. Moreover, the image thickness of the X-ray tomogram which should be generated can be chosen using an image thickness selection means. Furthermore, the scanning conditions of helical scan can be chosen using a scanning condition selection means.
[0020] The multi-detector which has two or more detector trains arranged in the 14th viewpoint in parallel to the X-ray tube with which this invention carries out outgoing radiation of the X-ray, An image thickness selection means to choose the image thickness of the X-ray tomogram which should be generated by the helical scan using the multi-detector, The X-ray irradiation dosage preliminary decision means which carries out the preliminary decision of the X-ray irradiation dosage in the case of obtaining the X-ray tomogram for said image thickness by the single-slice CT by the X-ray irradiation dosage decision algorithm for single-slice CTs, A scanning condition selection means to choose the scanning conditions of the helical scan which should be performed, The exposure dose correction factor table which stores image thickness and the exposure dose correction factor for every scanning conditions, An exposure dose amendment means to read the exposure dose correction factor corresponding to said selected image thickness and selected, scanning conditions from said correction factor table, to carry out multiplication to said X-ray irradiation dosage which carried out the preliminary decision, and to amend said X-ray irradiation dosage which carried out the preliminary decision, The X-ray CT scanner characterized by providing the scanning control means which controls the helical scan which suits said amended X-ray irradiation dosage is offered. In the X-ray CT scanner by the 14th viewpoint of the above, the same operation as the X-ray CT scanner by the 13th viewpoint of the above is done so. Moreover, since the exposure dose

correction factor corresponding to the slice thickness and the scanning conditions which should be performed is read from an exposure dose correction factor table and X-ray irradiation dosage is amended using the exposure dose correction factor, the exposure dose which suited scanning conditions is computable by the easy operation.
[0021] In the X-ray CT scanner according [this invention] to the 14th viewpoint of the above at the 15th viewpoint said exposure dose correction factor table It is created corresponding to two or more image thickness which may be chosen, and X-ray irradiation dosage when performing the axial scan of the same slice thickness as said image thickness by the single-slice CT to the phantom which imitated CT value distribution of standard analyte is made into a reference value. The X-ray CT scanner characterized by storing the quantity-of-radiation correction factor which expressed the X-ray irradiation dosage for obtaining the X-ray tomogram for an image noise value equivalent to said axial scan by the helical scan using said multi-detector with the scale factor to said reference value is offered. In the X-ray CT scanner by the 15th viewpoint of the above, since X-ray irradiation dosage is amended with the quantity-of-radiation correction factor which makes a reference value X-ray irradiation dosage when performing an axial scan to a phantom, the X-ray irradiation dosage which suited photography of analyte is computable with a sufficient precision.
[0022] In the 16th viewpoint, this invention offers the X-ray CT scanner characterized by said exposure dose correction factor table storing the passing speed of a photography berth, and the exposure dose correction factor for every X-ray beam width of face of a scanning core in the scanning condition decision approach for tomography by the 14th viewpoint of the above, or the viewpoint of the above 15. In the X-ray CT scanner by the 16th viewpoint of the above, since the passing speed of a photography berth and the exposure dose correction factor for every X-ray beam width of face which are used abundantly as scanning conditions are stored in an exposure dose correction factor table, the user-friendliness and photography effectiveness on clinical can be improved further.
[0023]
[Embodiment of the Invention] Hereafter, the gestalt of operation shown in drawing explains this invention to a detail further. In addition, thereby, this invention is not limited. Drawing 1 is the block diagram showing the X-ray CT scanner concerning 1 operation gestalt of this invention. This X-ray CT scanner 100 possesses the actuation console 1, the photography berth 10, and the scan gantry 20. The input unit 2 with which said console 1 receives a directions input, an information input, etc. of an operator, The central processing unit 3 which performs X-ray-computed-tomography processing including the processing which carries out the preliminary decision of the X-ray irradiation dosage required for helical scan etc., The control interface 4 which exchanges a control signal etc. with said photography berth 10 and said scan gantry 20, The capture buffer 5 which collects the data acquired by said scan gantry 20, CRT6 which displays the X-ray tomogram reconfigurated from said data, the storage 7 which memorizes a program, data, and an X-ray tomogram, and the exposure dose correction factor table 8 which stores the exposure dose correction factor for amending the X-ray irradiation dosage which carried out the preliminary decision are provided.
[0024] Said scan gantry 20 possesses the multi-detector 27 which has the detector train of four trains arranged in parallel to X-ray tube 21, the X-ray controller 22, the collimator 23, the collimator controller 24, and the rotation controller 26 made to rotate said X-ray tube 21 etc. around a scanning core (SC of drawing 2), and the data collection section 28 which collects the data picked out from the multi-detector 27.
[0025] Drawing 2 is the mimetic diagram showing X-ray tube 21, a collimator 23, and the multi-detector 27. X-ray Io by which outgoing radiation was carried out from X-ray tube 21 serves as flat X-ray beam Xr by passing along the aperture S of a collimator 23, and carries out incidence to the 1st - the 4th detector trains 27A-27D of the multi-detector 27. Based on the command of said central processing unit 3, said collimator controller 24 adjusts the aperture width and the location of Aperture S of said collimator 23. The width of face of X-ray beam Xr in the scanning pin center,large SC is called X-ray beam width of face Xo. Moreover, the width of face of the part which carries out incidence to said 1st detector train 27A among said X-ray beam width of face Xo is the 1st slice thickness Ao, the width of face of the part which carries out incidence to 2nd detector train 27B is the 2nd slice thickness Bo, the width of face of the part which carries out incidence to 3rd detector train 27C is the 3rd slice thickness Co, and the width of face of the part which carries out incidence to 4th detector train 27D is the 4th slice thickness Do.
[0026] Drawing 3 is the explanatory view showing the contents of said exposure dose correction factor table 8. Illustration corresponds to image thickness IT=5mm. It is stored by the isomorphism formula also about other image thickness IT which may be chosen. The passing speed [mm/rotation] of said photography berth 10 and the quantity-of-radiation correction factor of every X-ray beam width-of-face Xo[mm] of the scanning core SC are stored beforehand. Said quantity-of-radiation correction factor expresses the X-ray irradiation dosage for obtaining the X-ray tomogram for

an image noise value equivalent to said axial scan by the helical scan of the image thickness IT using the multi-detector 27 with the scale factor to said reference value by making into a reference value X-ray irradiation dosage when performing the axial scan of slice thickness Th=IT by the single-slice CT to the phantom which imitated CT value distribution of standard analyte. Generally, image quality of an X-ray tomogram can be made high, so that the passing speed of the photography berth 10 is small (so that No. of drawing is small). Moreover, irradiation time can be shortened, so that the passing speed of the photography berth 10 is large (so that No. of drawing is large).

[0027] Drawing 4 is the flow Fig. showing the X-ray-computed-tomography processing by X-ray CT scanner 100 of drawing 1 . At a step ST 1, an operator chooses the image thickness IT. For example, 5mm is chosen as image thickness IT. adjustment of said image thickness IT -- for example, said the 1- it carries out by changing the element of the weight which compounds the data taken out from the 4th detector train 27A-27D, the X-ray beam width of face Xo of the scanning pin center,large SC, or the passing speed of the photography berth 10. In addition, the technique of adjusting image thickness by changing the weight function used for interpolation of the data collected with the X-ray CT scanner equipped with the multi-detector is indicated by JP,9-238935,A. At a step ST 2, the preliminary decision of X-ray irradiation dosage scan_mAs for performing an axial scan and obtaining the X-ray tomogram for the same slice thickness as said image thickness IT with a desired image noise value is carried out based on the X-ray irradiation dosage decision algorithm for single-slice CTs, for example, X-ray irradiation dosage decision processing in which it explained with reference to drawing 5 previously. For example, a preliminary decision is carried out to X-ray irradiation dosage scan_mAs=200[mAs]. At a step ST 3, an operator chooses the scanning protocol of the helical scan which it is going to perform. For example, 7.5 [mm/rotation] is chosen as passing speed of the photography berth 10, and 2.5 [mm] is chosen as X-ray beam width of face Xo.

[0028] At a step ST 4, the exposure dose correction factor corresponding to table passing speed and the X-ray beam width of face Xo is read from the exposure dose correction factor table 8 corresponding to the selected image thickness IT. In the above-mentioned example, the exposure dose correction factor 0.68 corresponding to No.1 of the exposure dose correction factor table 8 of drawing 3 is read.

[0029] At a step ST 5, the multiplication of the read quantity-of-radiation correction factor is carried out to X-ray irradiation dosage scan_mAs determined at the above-mentioned step ST 2, and X-ray irradiation dosage is amended. In the above-mentioned example, X-ray irradiation dosage scan_mAs after amendment is set to 136 [mAs] by X-ray irradiation dosage 200[mAs] x0.68. At a step ST 6, an operator sets up at least one side of the tube electric current and irradiation time according to X-ray irradiation dosage scan_mAs after amendment, and determines the scanning conditions for tomography (an automatic decision may be made without an operator's mediation). For example, if the tube electric current is set as 100 [mA], irradiation time will be determined as 1.36 [s]. Moreover, if irradiation time is set as 0.8 [s], the tube electric current will be determined as 170 [mA]. When the tube electric current is set up preferentially, it can prevent certainly the load which joins said X-ray tube 21 becoming excessive, and forming a short life. When irradiation time is set up preferentially, a body motion can adjust scanning time amount in consideration of the effect which it has on image quality. The helical scan which photos a predetermined part based on the determined scanning conditions for tomography is performed, and the X-ray tomogram for the image thickness IT is generated and expressed as a step ST 7.

[0030] Since according to above X-ray CT scanner 100 the quantity of radiation in which the preliminary decision was carried out by the X-ray irradiation dosage decision algorithm for single-slice CTs is amended so that the image noise value of the X-ray tomogram obtained by helical scan may not serve as excess and deficiency to an allowed value, the amount of X-ray exposures of analyte can be controlled to the minimum.

[0031]

[Effect of the Invention] Since the quantity of radiation to analyte is controlled by the minimal dose which fulfills the conditions of an image noise value according to the scanning condition decision approach for tomography and the tomography approach of this invention, analyte can prevent un-arranging [which is contaminated superfluously]. Moreover, since the X-ray tomogram which fulfills the conditions of an image noise value can be obtained in the minimum amount of X-ray irradiation according to the X-ray CT scanner of this invention, safety can be improved further.

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] The image thickness of the tomogram which should be generated by the helical scan by the CT scanner equipped with the multi-detector which has two or more detector trains arranged in parallel is chosen. The preliminary decision of the quantity of radiation in the case of obtaining the tomogram for said image thickness by the single-slice CT is carried out by the quantity-of-radiation decision algorithm for single-slice CTs. Choose the scanning conditions of the helical scan which should be performed, and said quantity of radiation which carried out the preliminary decision is amended so that it may become the quantity of radiation from which the image noise value of the tomogram obtained by performing the helical scan by said scanning conditions does not serve as excess and deficiency to an allowed value. The scanning condition decision approach for tomography characterized by determining the scanning conditions for tomography which suited the amended this quantity of radiation.
[Claim 2] The scanning condition decision approach for tomography characterized by setting up preferentially the supply current to the source of an exposure, and one side of irradiation time in the scanning condition decision approach for tomography according to claim 1 that the exposure line of said amended quantity of radiation should be irradiated.
[Claim 3] The scanning condition decision approach for tomography characterized by changing at least one element in the weight function at the time of compounding the data of each train of said multi-detector for image reconstruction, exposure line beam width, and the passing speed of the photography berth in which analyte is laid in the scanning condition decision approach for tomography according to claim 1 or 2, and adjusting image thickness.
[Claim 4] The tomography approach characterized by performing the helical scan of the scanning conditions for tomography determined as either of claim 1 to claims 3 by the scanning condition decision approach for tomography of a publication, and generating a tomogram.
[Claim 5] The multi-detector which has two or more detector trains arranged in parallel to the X-ray tube which carries out outgoing radiation of the X-ray, An image thickness selection means to choose the image thickness of the X-ray tomogram which should be generated by the helical scan using the multi-detector, The X-ray irradiation dosage preliminary decision means which carries out the preliminary decision of the X-ray irradiation dosage in the case of obtaining the X-ray tomogram for said image thickness by the single-slice CT by the X-ray irradiation dosage decision algorithm for single-slice CTs, A scanning condition selection means to choose the scanning conditions of the helical scan which should be performed, An X-ray irradiation dosage amendment means to amend said X-ray irradiation dosage which carried out the preliminary decision so that it may become the X-ray irradiation dosage from which the image noise value of the X-ray tomogram obtained by performing the helical scan by said scanning conditions does not serve as excess and deficiency to an allowed value, The X-ray CT scanner characterized by providing the scanning control means which controls the helical scan which suits said amended X-ray irradiation dosage.
[Claim 6] The multi-detector which has two or more detector trains arranged in parallel to the X-ray tube which carries out outgoing radiation of the X-ray, An image thickness selection means to choose the image thickness of the X-ray tomogram which should be generated by the helical scan using the multi-detector, The X-ray irradiation dosage preliminary decision means which carries out the preliminary decision of the X-ray irradiation dosage in the case of obtaining the X-ray tomogram for said image thickness by the single-slice CT by the X-ray irradiation dosage decision algorithm for single-slice CTs, A scanning condition selection means to choose the scanning conditions of the helical scan which should be performed, The exposure dose correction factor table which stores image thickness and the exposure dose correction factor for every scanning conditions, An exposure dose amendment means to read the exposure

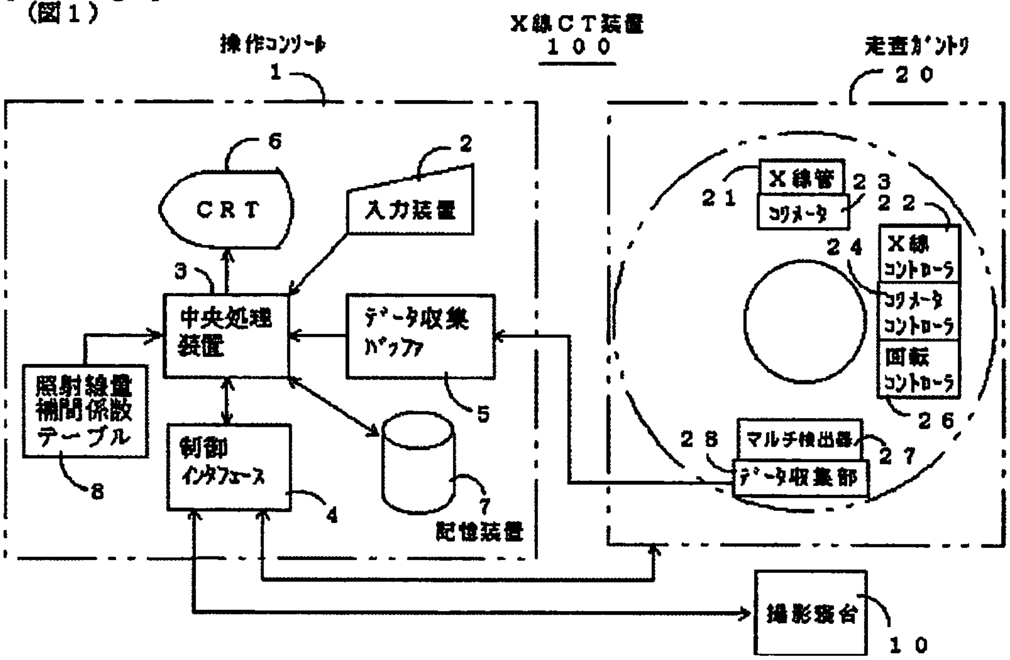
dose correction factor corresponding to said selected image thickness and selected, scanning conditions from said correction factor table, to carry out multiplication to said X-ray irradiation dosage which carried out the preliminary decision, and to amend said X-ray irradiation dosage which carried out the preliminary decision, The X-ray CT scanner characterized by providing the scanning control means which controls the helical scan which suits said amended X-ray irradiation dosage.

[Translation done.]

DRAWINGS

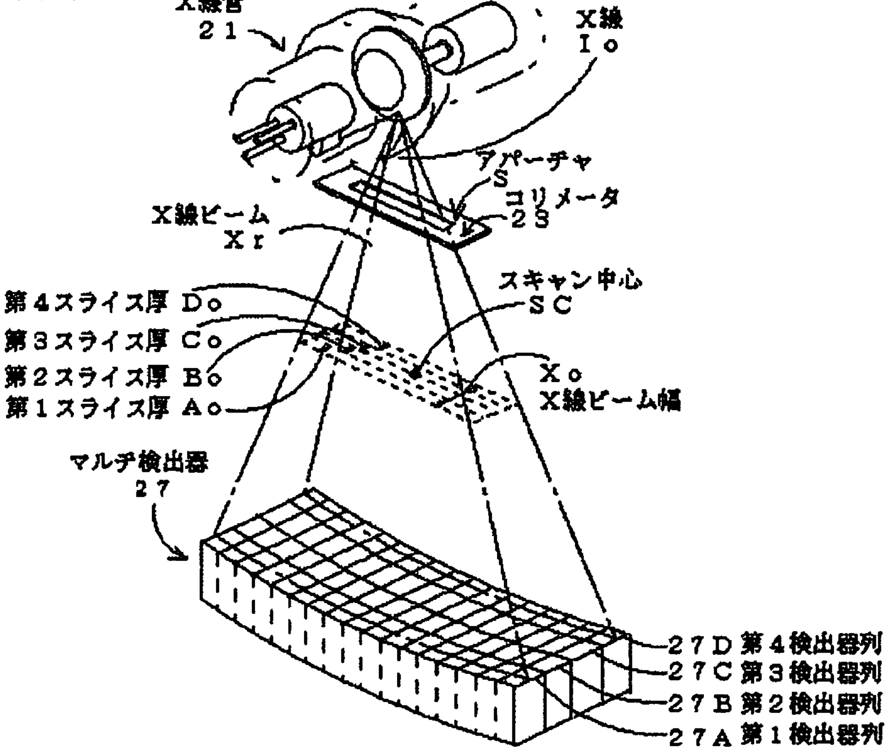
[Drawing 1]

(図1)



[Drawing 2]

(図2)



[Drawing 3]

(図3) 照射線量補正係数テーブル

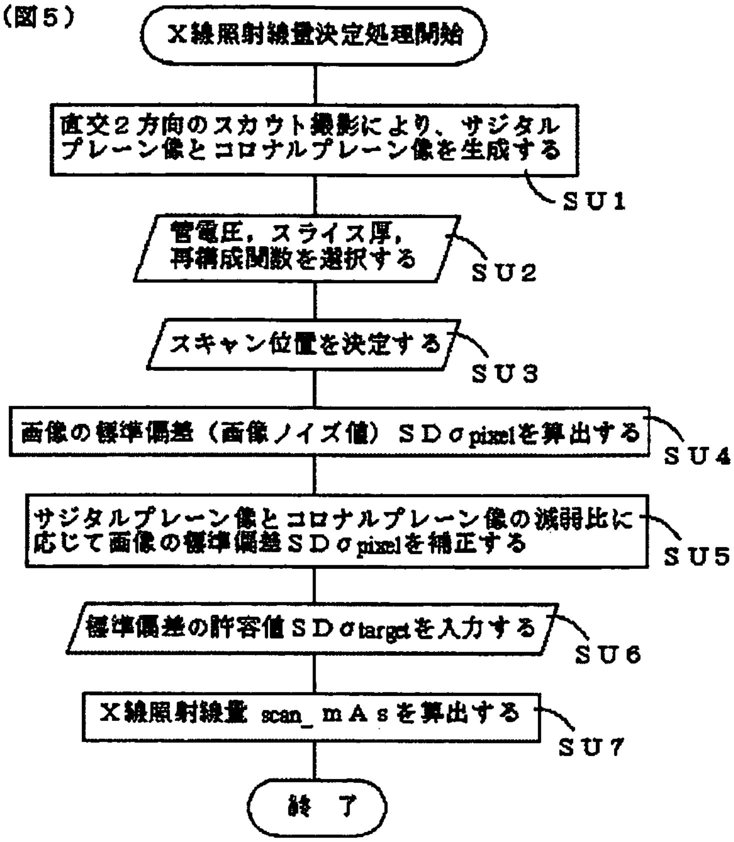
8

(イメージ厚；5mm)

No.	撮影寝台移動速度〔mm/回転〕	スキャン中心X線ビーム幅〔mm〕	照射線量補正係数
1	7.5	2.5	0.68
2	11.25	3.75	0.69
3	15.0	5.0	0.85
4	15.0	2.5	1.34
5	22.5	3.75	1.38
6	30.0	5.0	1.32

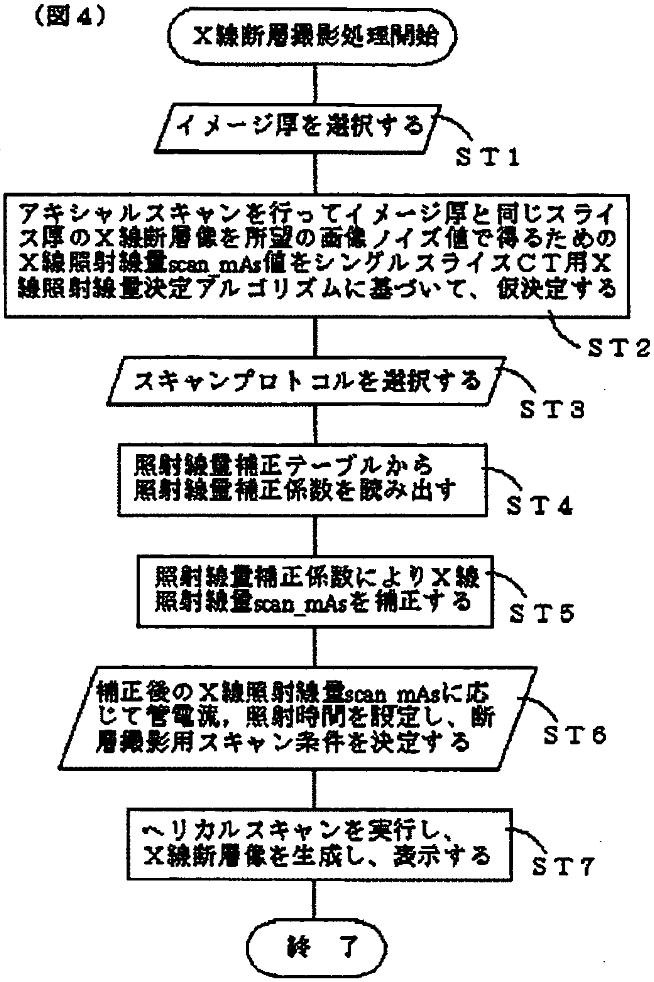
[Drawing 5]

(図５)


Ｘ線照射線量決定処理開始
直交２方向のスカウト撮影により、サジタルプレーン像とコロナルプレーン像を生成する
ＳＵ１
管電圧，スライス厚，再構成関数を選択する
ＳＵ２
スキャン位置を決定する
ＳＵ３
画像の標準偏差（画像ノイズ値）ＳＤσpixelを算出する
ＳＵ４
サジタルプレーン像とコロナルプレーン像の減弱比に応じて画像の標準偏差ＳＤσpixelを補正する
ＳＵ５
標準偏差の許容値ＳＤσtargetを入力する
ＳＵ６
Ｘ線照射線量 scan_ｍＡｓを算出する
ＳＵ７
終 了

[Drawing 4]

(図4)



[Translation done.]